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Fujimura

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(54) **CONNECTOR**

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(Continued)

(52) **U.S. Cl.**
CPC ***H01R 13/56*** (2013.01); ***H01R 13/506*** (2013.01); ***H01R 13/516*** (2013.01);
(Continued)

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(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,832,922 B2 * 12/2004 Kozono H01R 13/447 439/135
8,197,271 B2 * 6/2012 Kobayashi H01R 13/62955 439/157

(Continued)

FOREIGN PATENT DOCUMENTS

JP	7-47819	11/1995
JP	2003-272768	9/2003
JP	2014-99267	5/2014

OTHER PUBLICATIONS

International Search Report dated Mar. 22, 2016.

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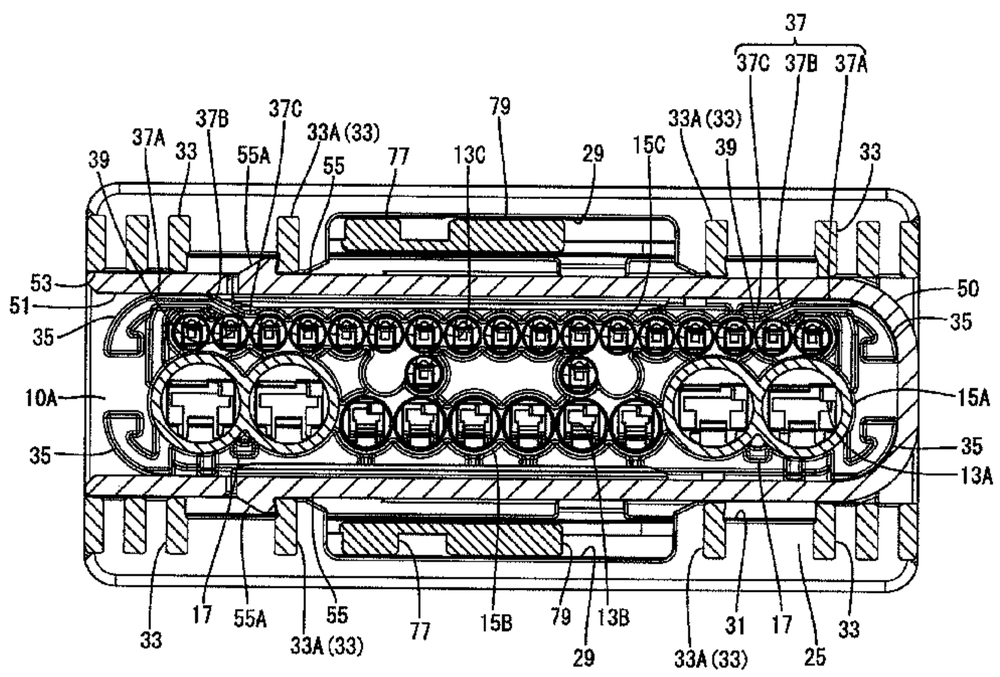
(57) **ABSTRACT**

A connector includes a connector housing **10** provided with cavities **13** for accommodating terminal fittings and connectable to a mating connector, a cover **50** configured to cover wires pulled out from the connector housing **10** by being mounted on a cover mounting surface **10**A side of the connector housing **10** opposite to a connection surface, locking pieces **55** deflectably provided on both side surfaces of the cover **50** and configured to lock the cover **50** to the connector housing **10** by projecting toward the connector housing **10**, and protection walls **37** provided on the connector housing **10**, the other locking piece **55** coming into contact with the protection wall **37** when being pushed in an unlocking direction when one of the locking pieces **55** is unlocked and the cover **50** is inclined with respect to the connector housing **10**.

4 Claims, 16 Drawing Sheets



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H01R 13/506 (2006.01)
H01R 13/516 (2006.01)
H01R 13/629 (2006.01)

(52) **U.S. Cl.**
CPC . ***H01R 13/62944*** (2013.01); ***H01R 13/62977*** (2013.01); *H01R 13/62955* (2013.01)

(58) **Field of Classification Search**
USPC 439/157, 345, 350, 357
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,721,373	B2 *	5/2014	Suzuki	H01R 13/506 439/589
2003/0176090	A1	9/2003	Kozono et al.	
2014/0134862	A1	5/2014	Itou et al.	

* cited by examiner

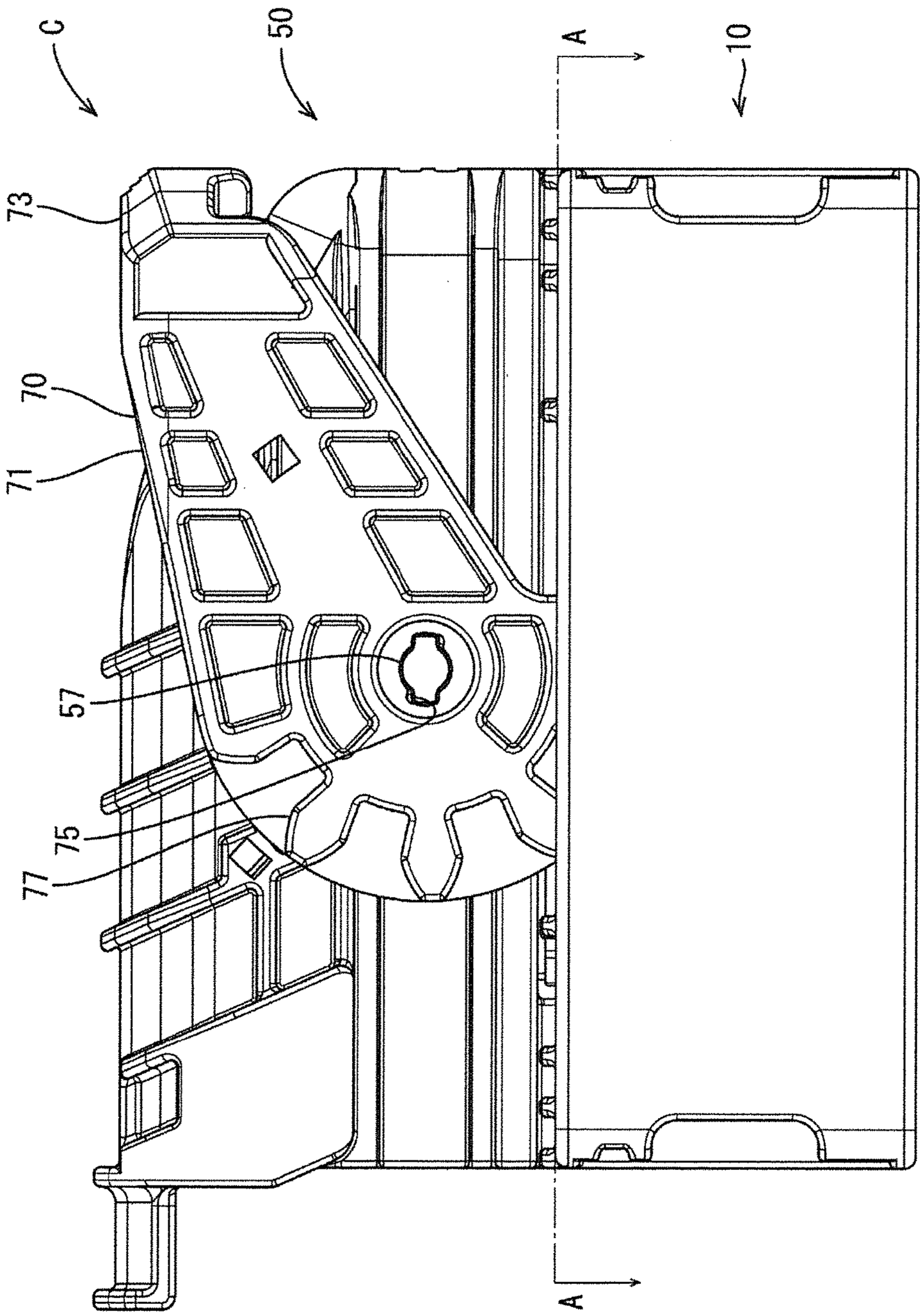


FIG. 1

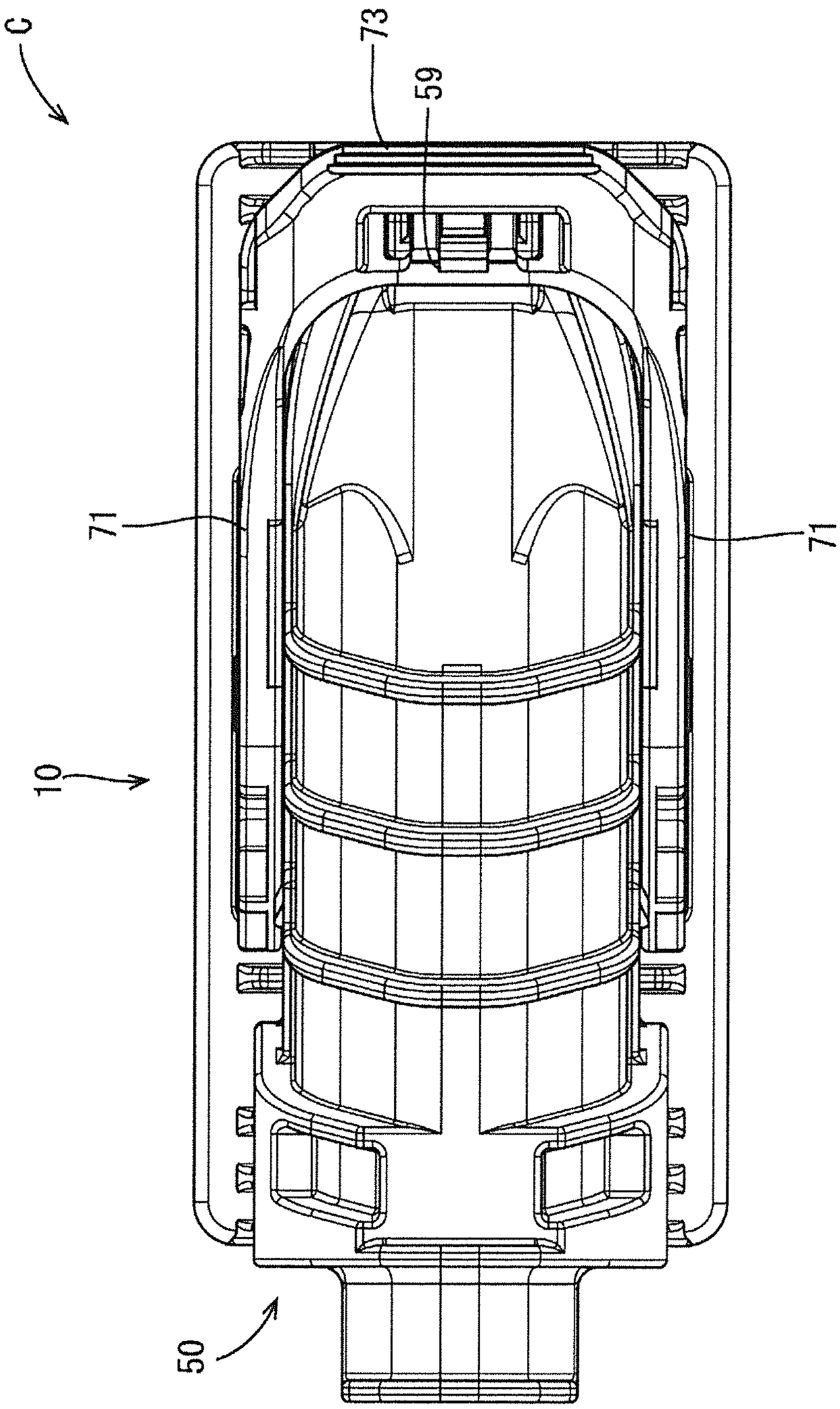
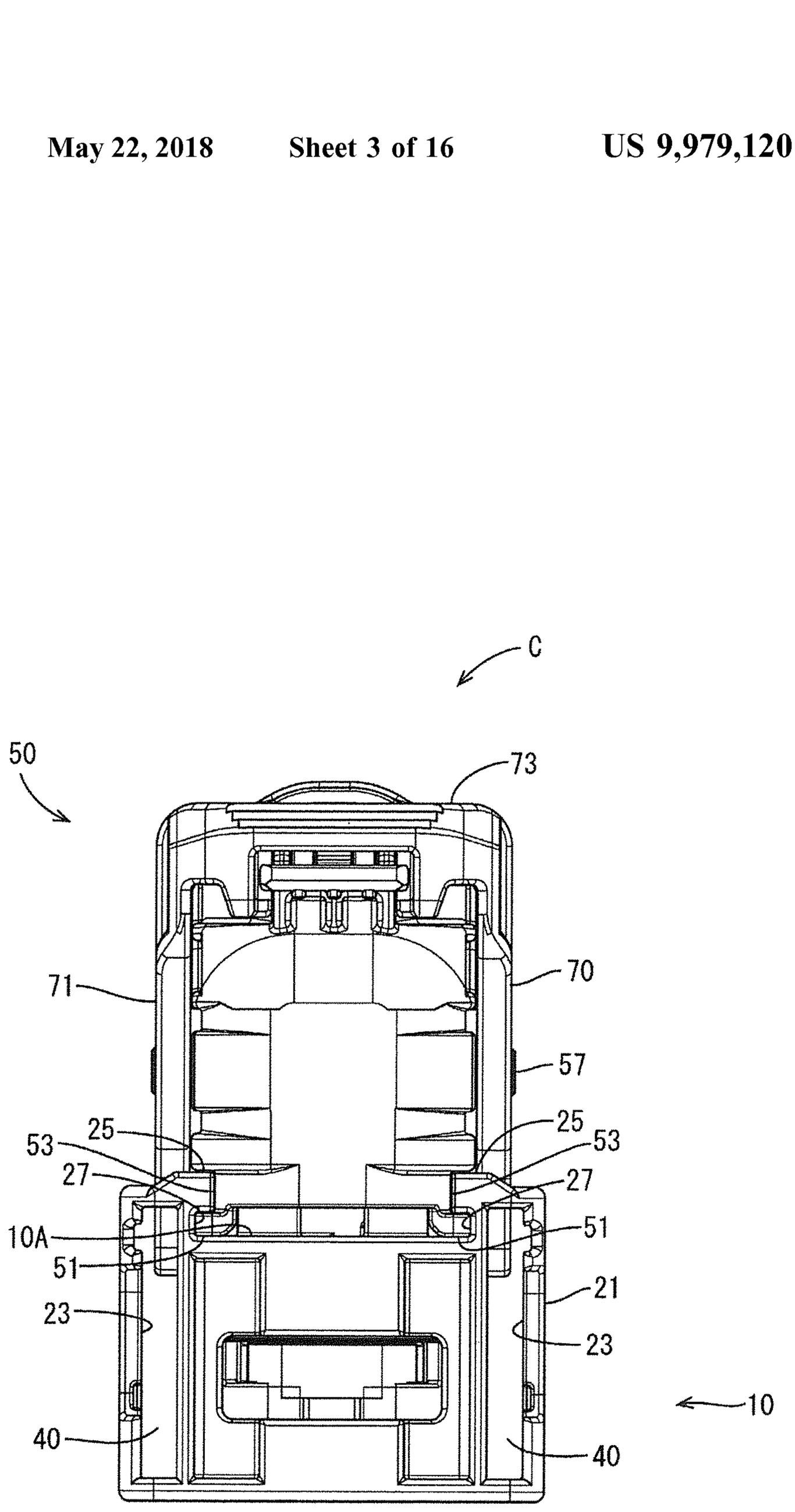


FIG. 2

FIG. 3



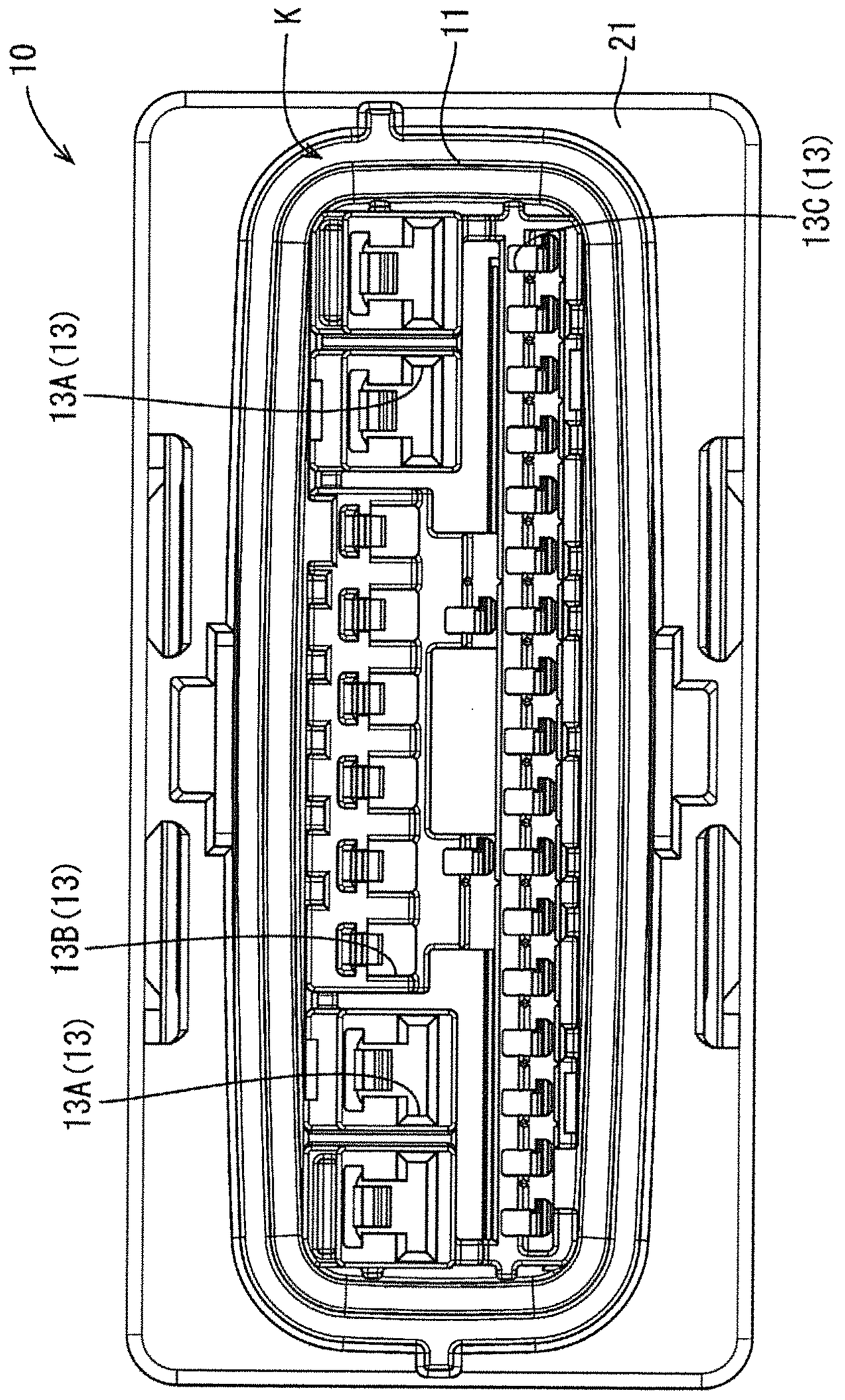
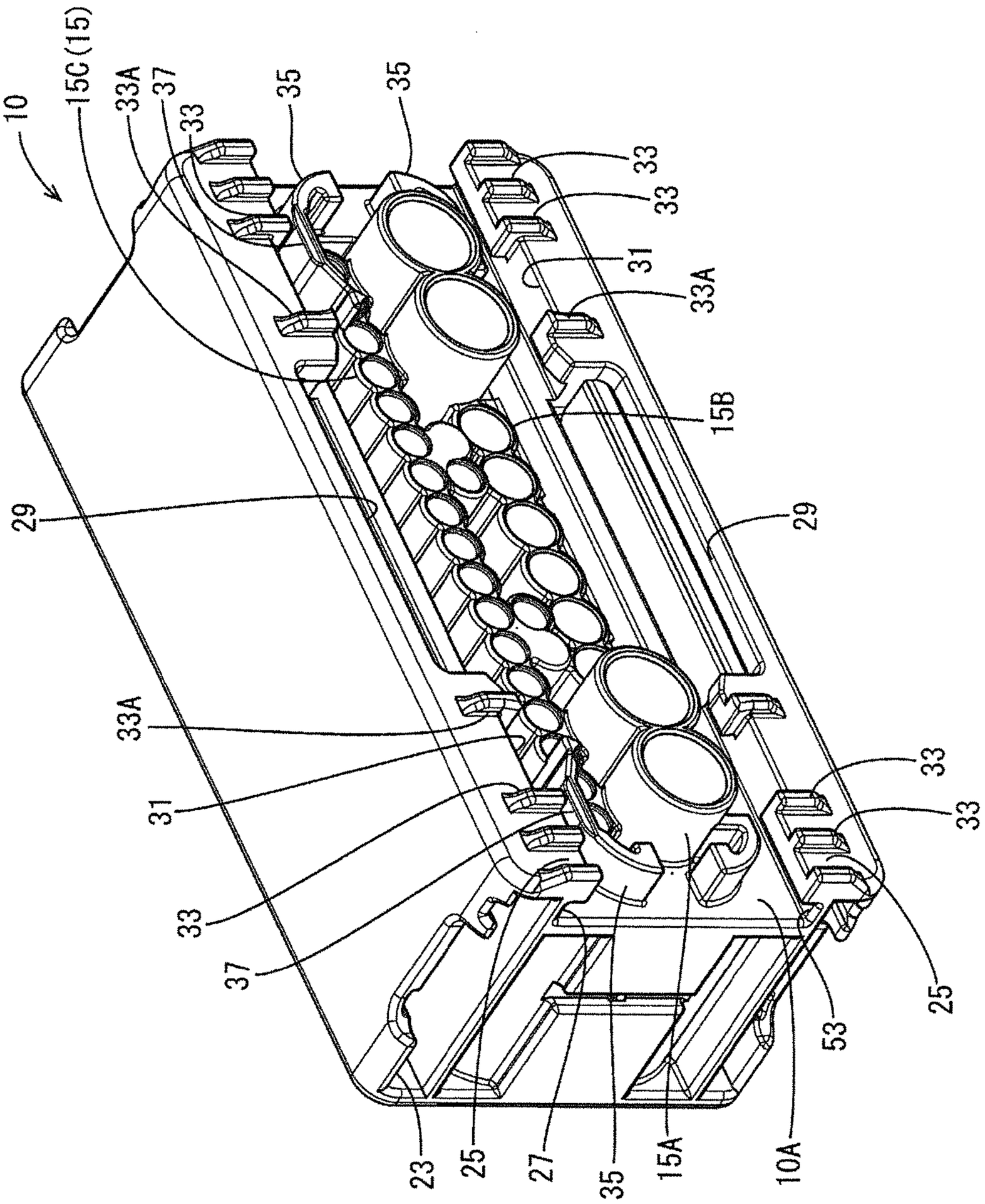


FIG. 4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33A
37
33
35
35
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33
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31
33A
15B
29
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33A
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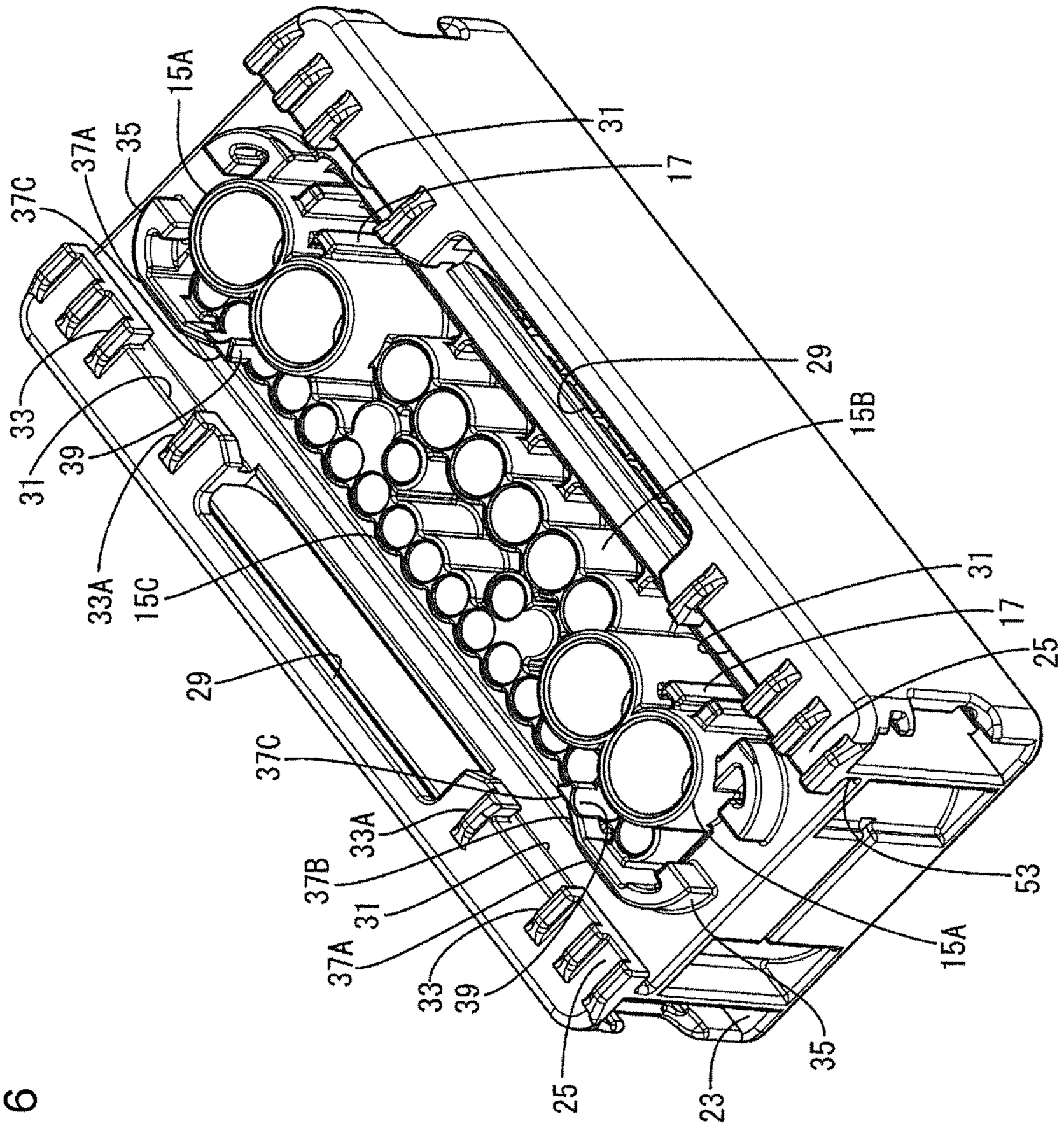
37
33
33
33
25
53
23
25
27
35
15A
10A

FIG. 5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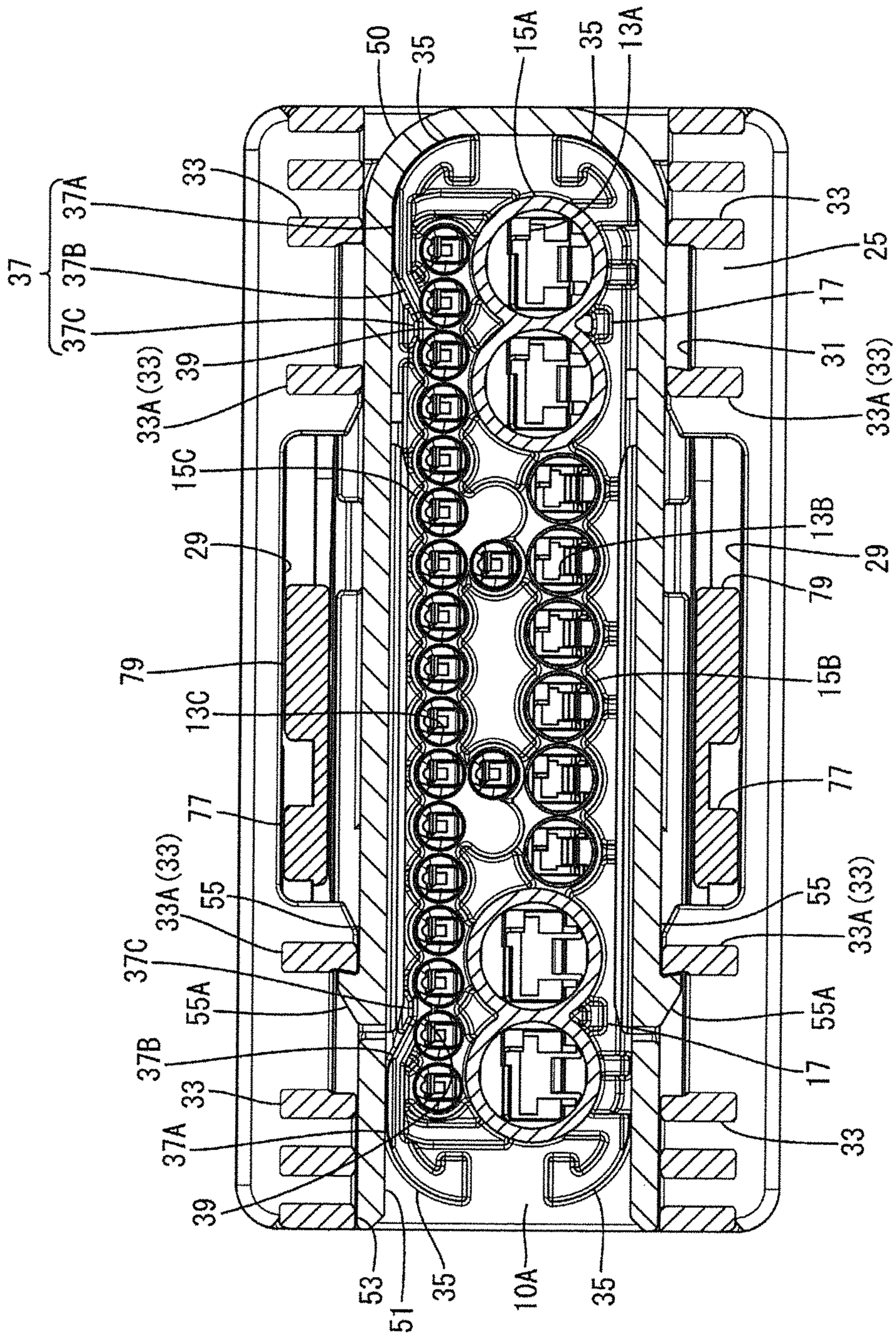
23
35
31
17
29
15B
31
17
25
53
15A

FIG. 6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37C
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55
37C
55A
37B
33
37A
39
53
51
35
10A
35
33
25
17
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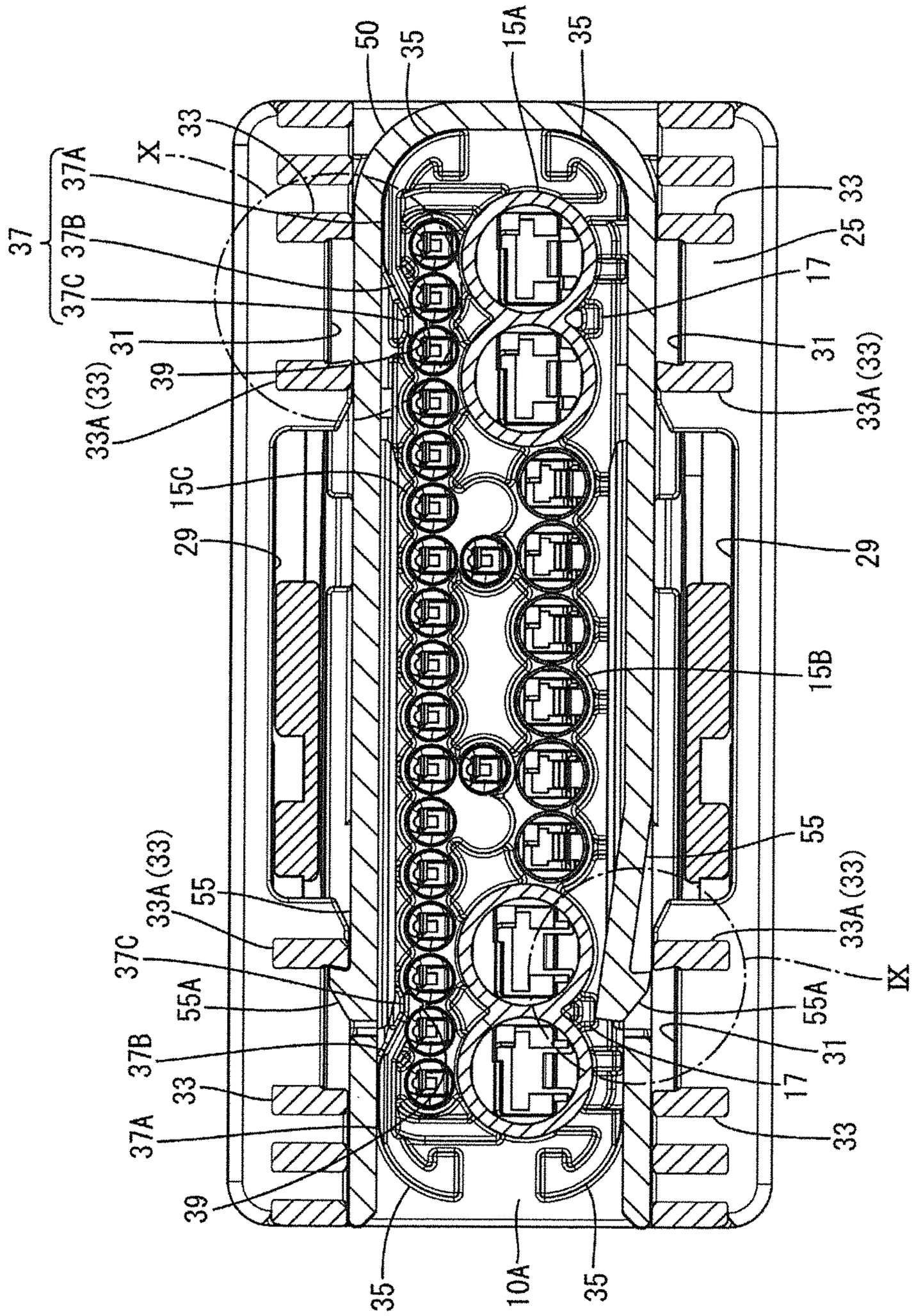
13B
29
79
15B
77
55
33A (33)
55A
17
33

FIG. 7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33A (33)
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15B
55
33A (33)
55
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37A
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55A
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17
33

FIG. 8

FIG. 9

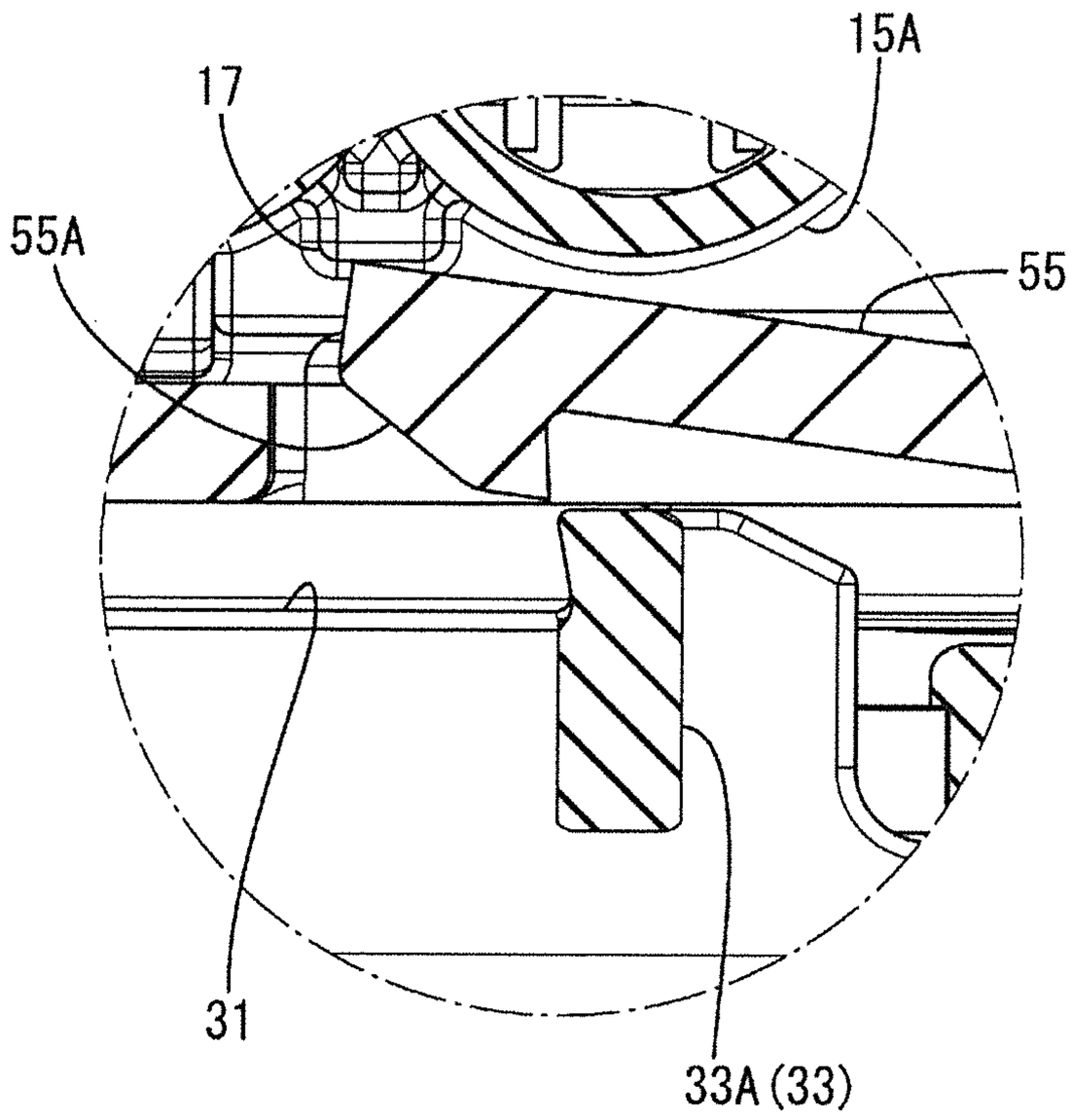
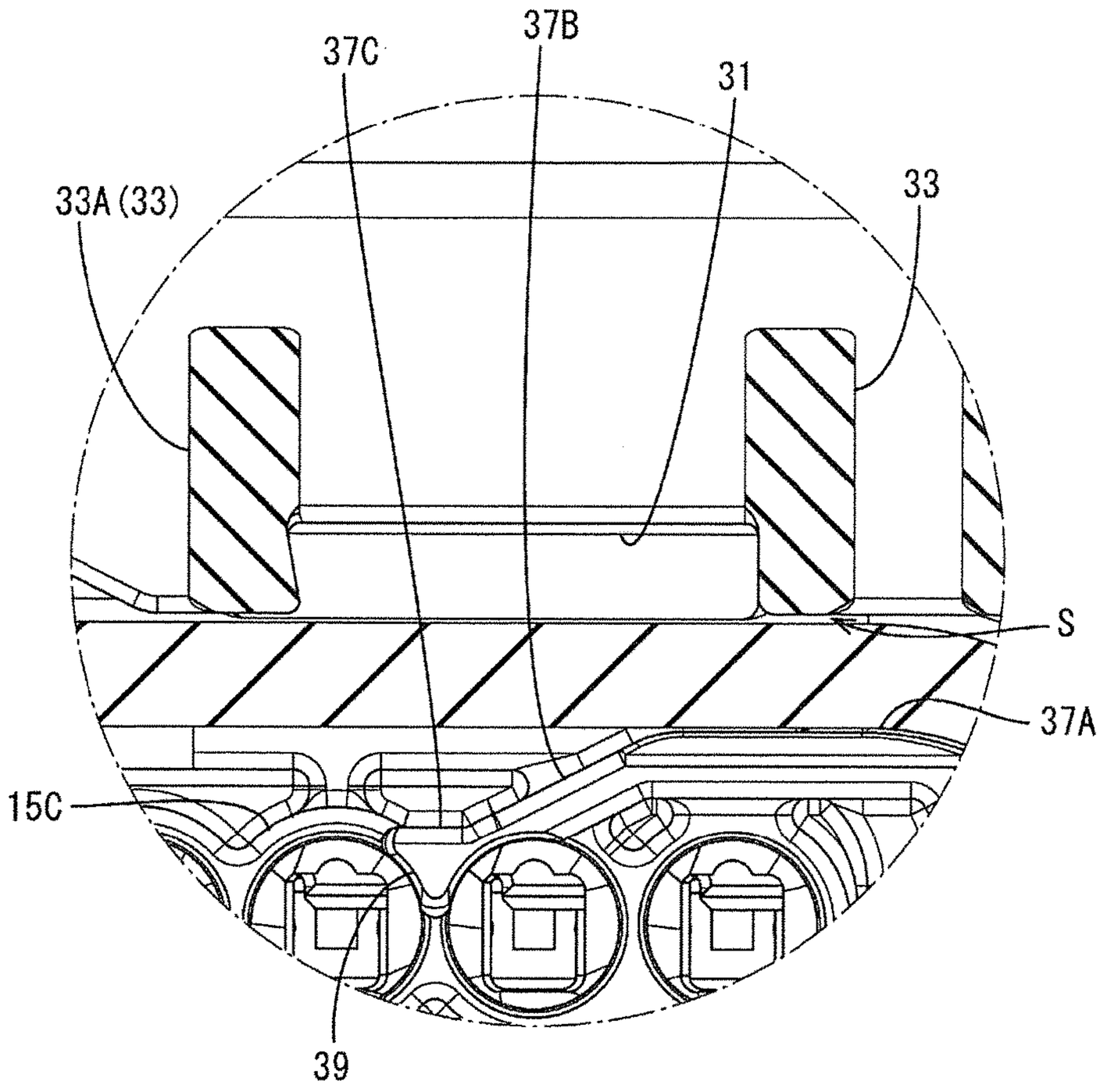
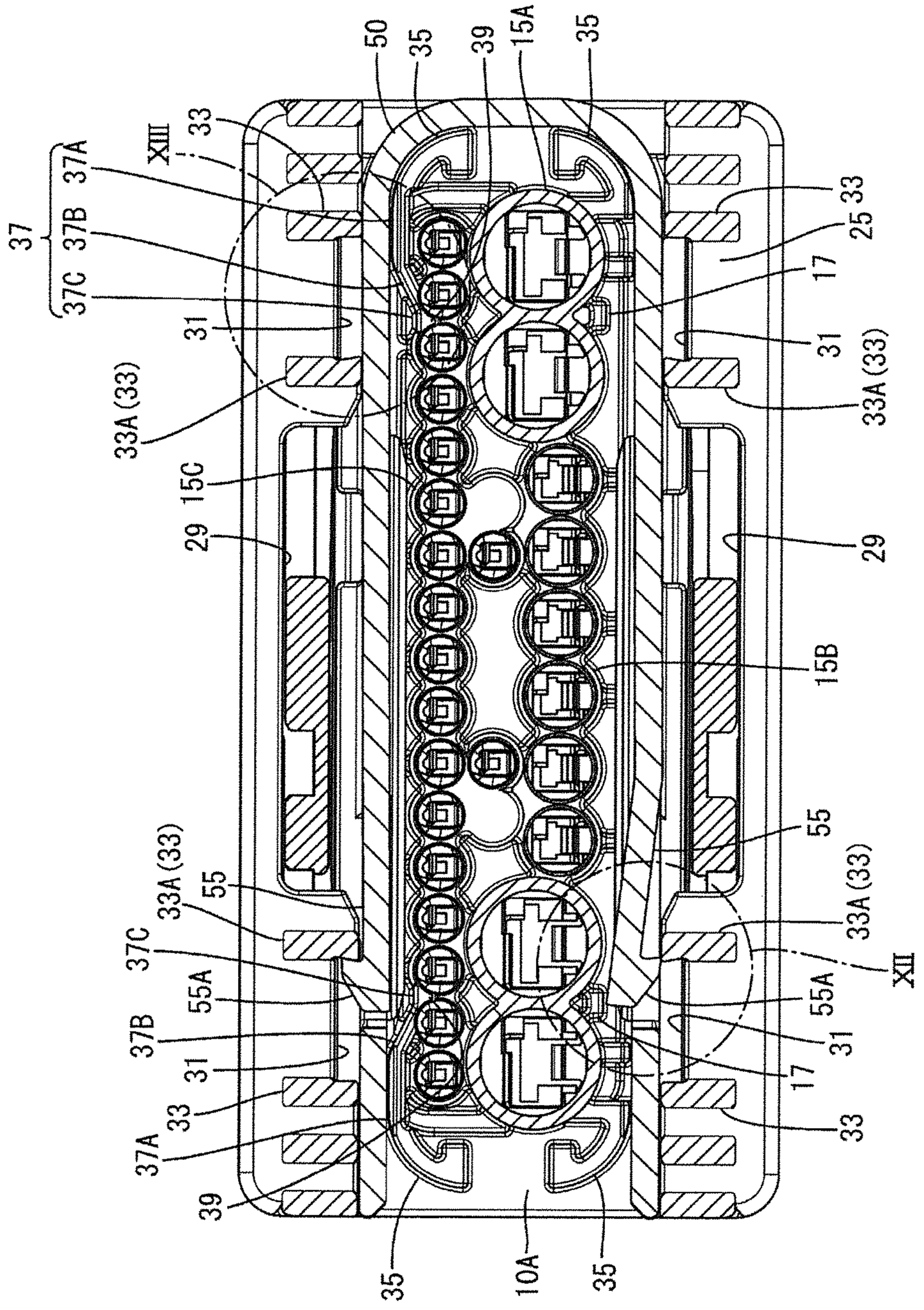


FIG. 10

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37B
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37A
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35
10A
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55A
31
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33
XII

FIG. 11

FIG. 12

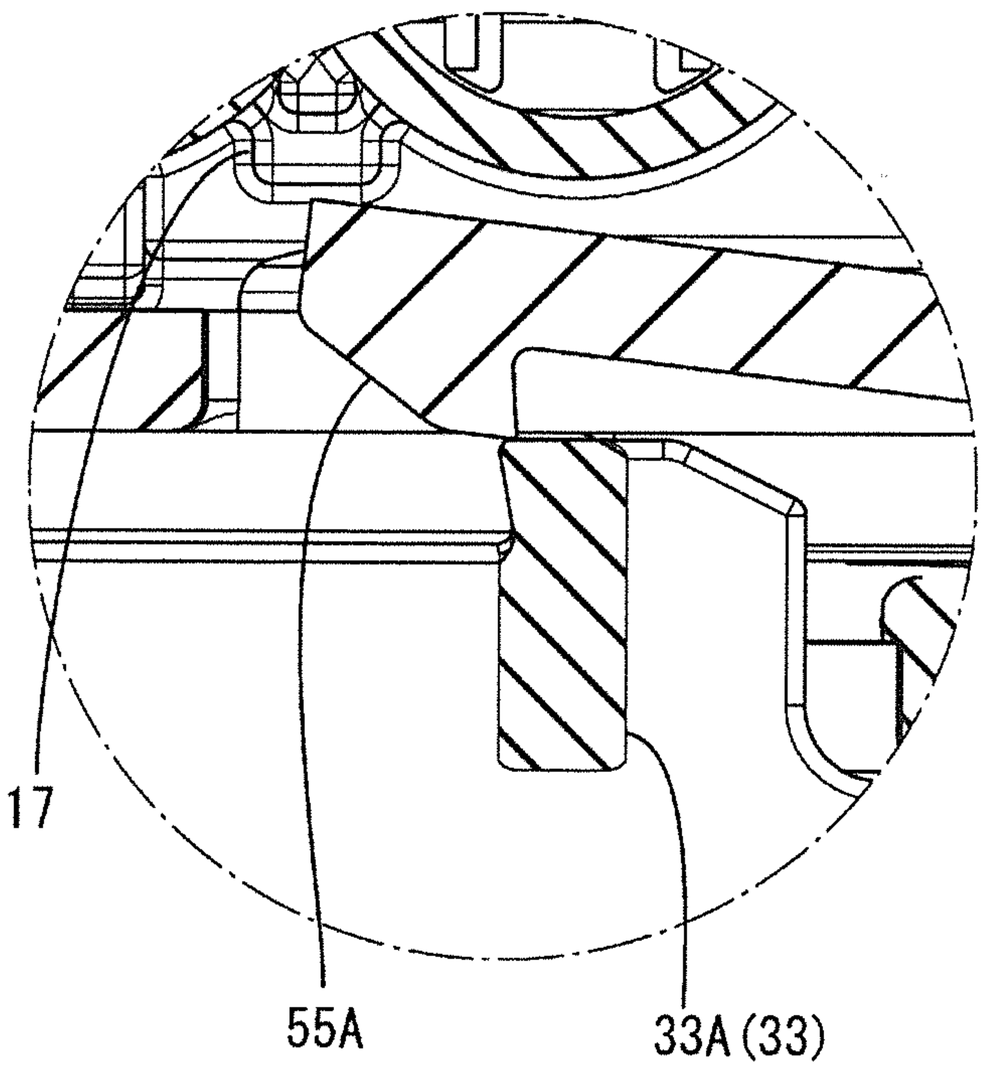
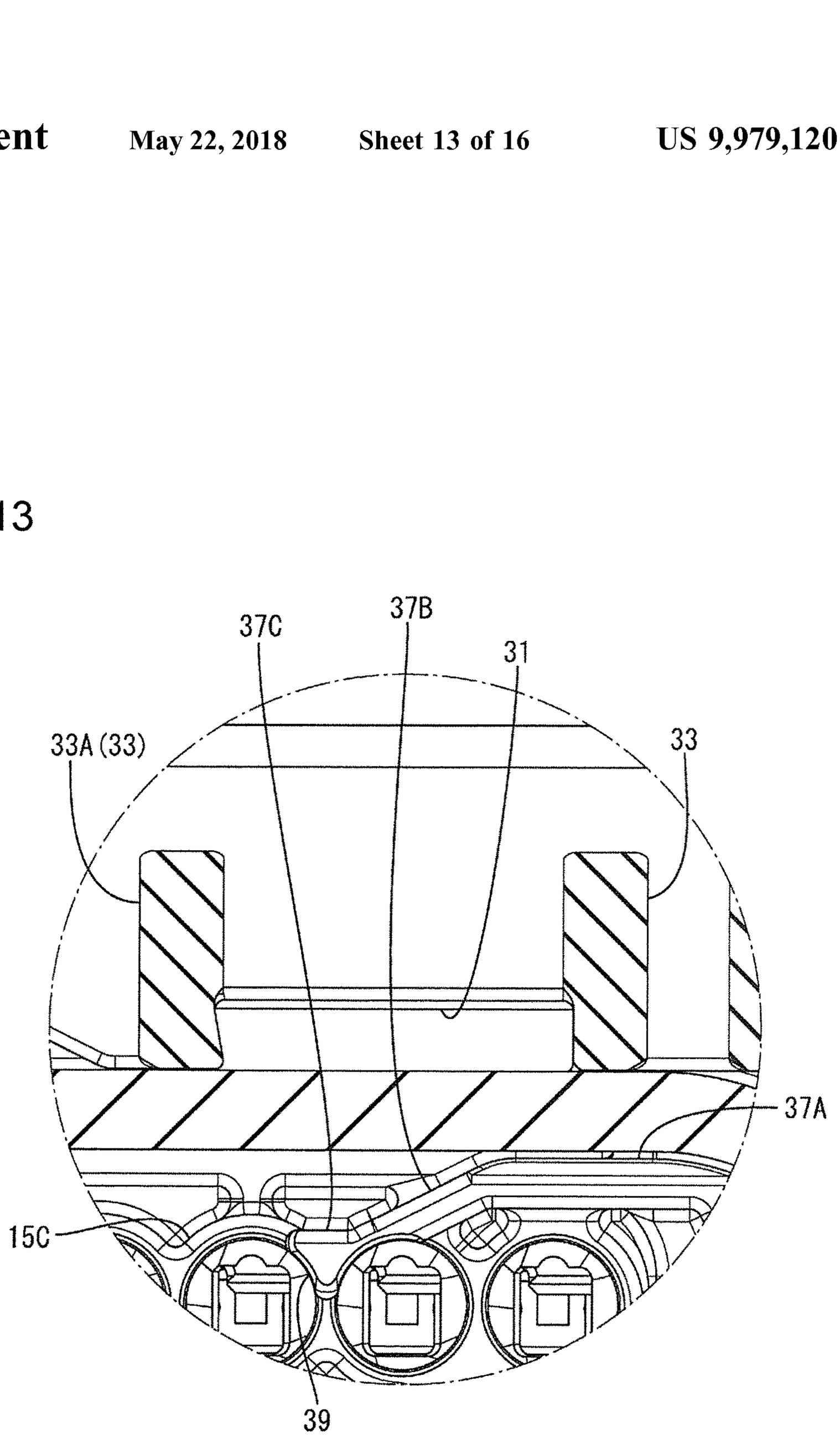
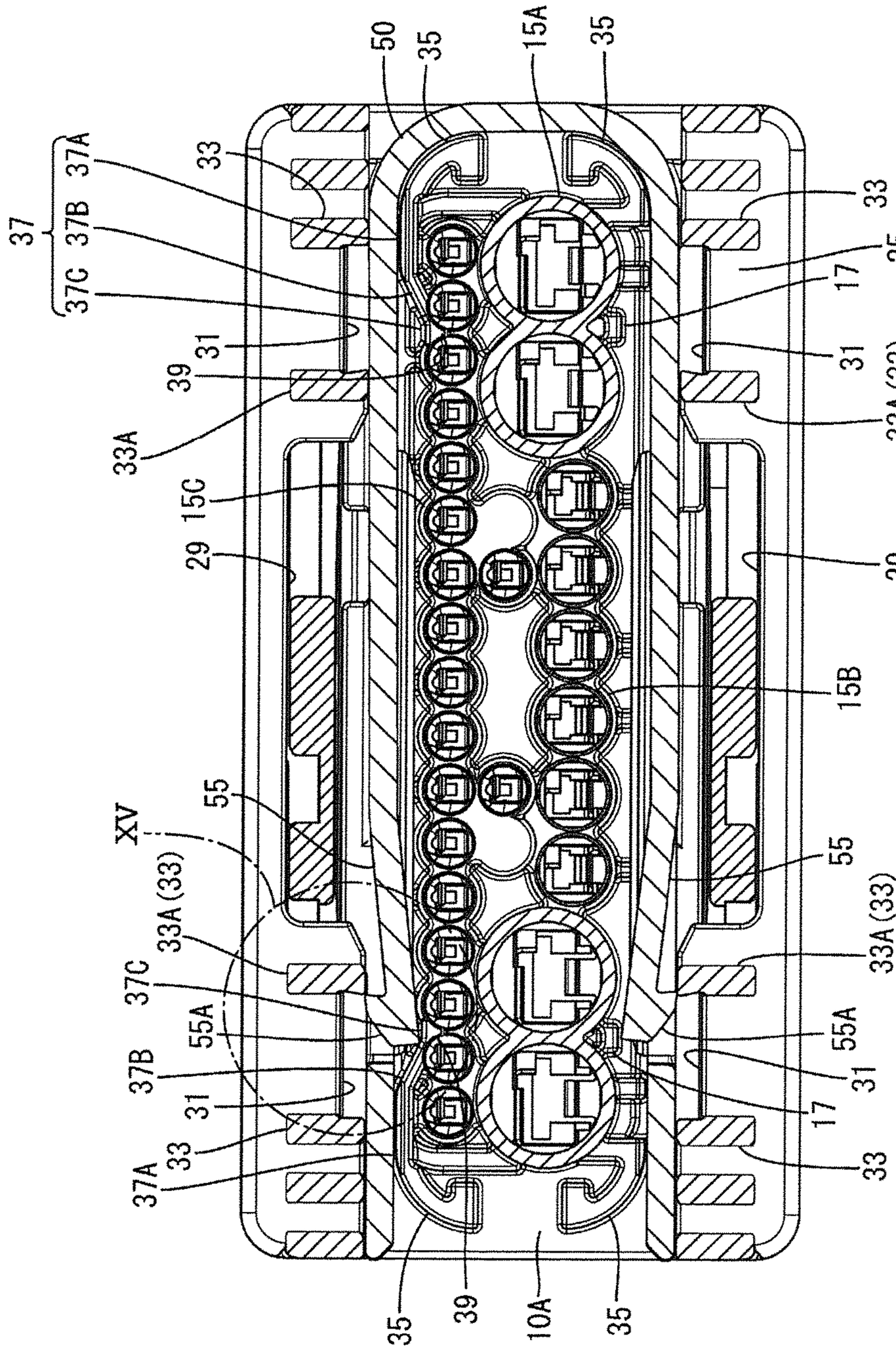


FIG. 13

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29
15B
XV
55
55
33A (33)
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10A
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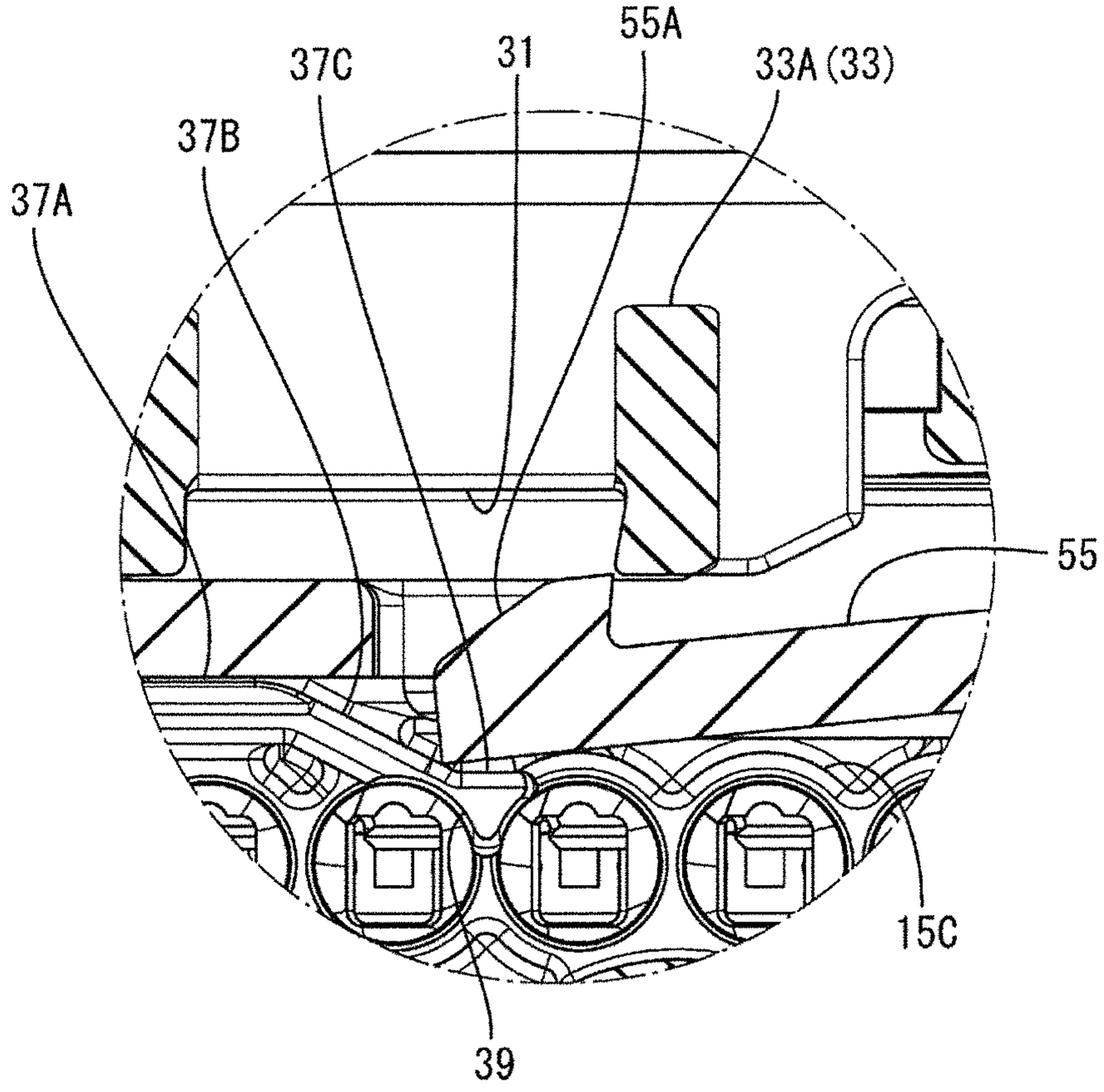
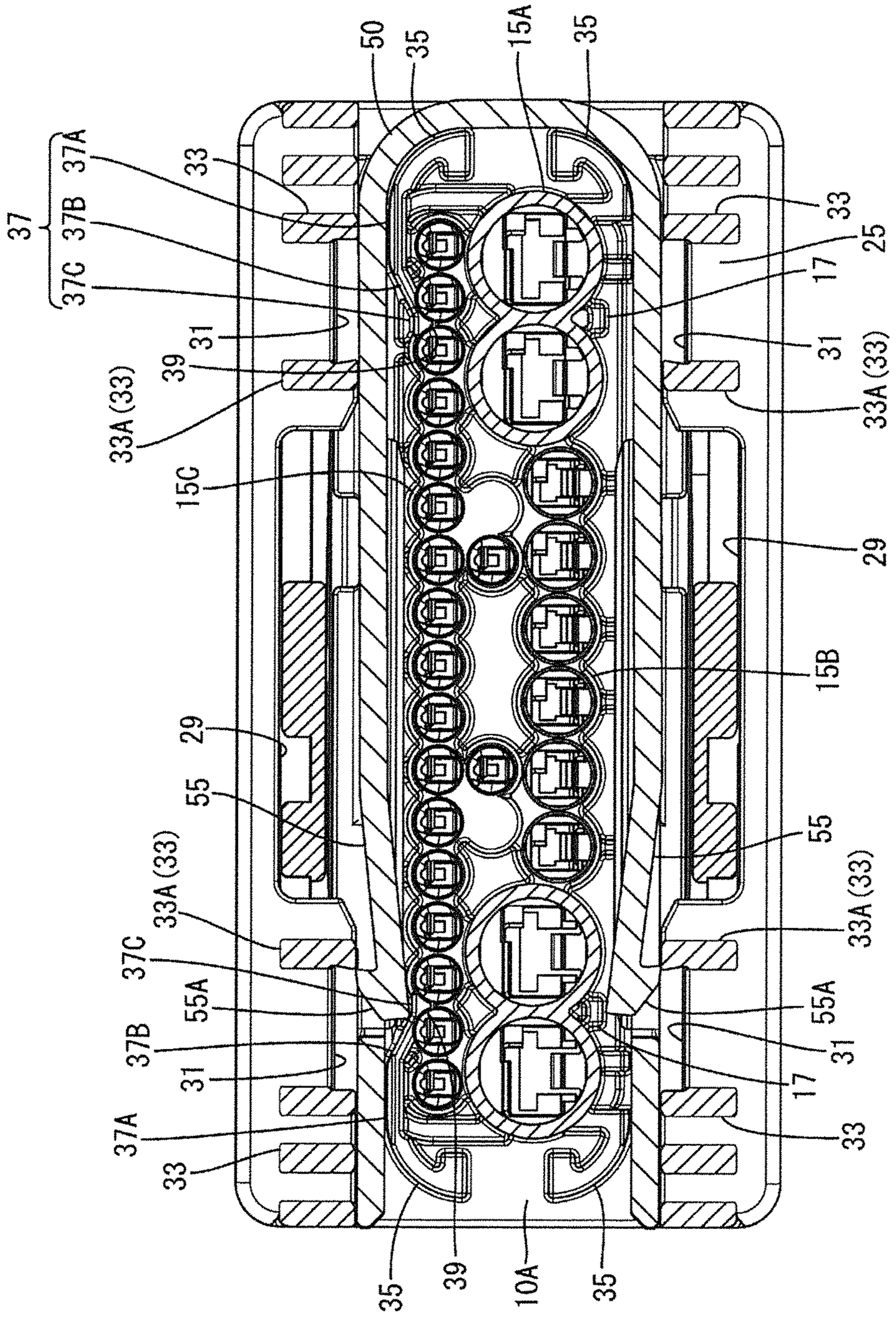
FIG. 14

FIG. 15

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29
29
15B
55
55
33A (33)
33A (33)
37C
55A
55A
37B
31
31
17
37A
33
33
35
39
10A
35

FIG. 16

CONNECTOR

BACKGROUND

1. Field of the Invention

This specification relates to a connector.

2. Description of the Related Art

A cover may be mounted on a connector housing to change a pull-out direction of wires pulled out from the connector housing. For example, Japanese Unexamined Patent Publication No. 2014-99267 discloses a connector with a connector housing provided with cavities for accommodating terminal fittings and a cover to be mounted on the connector housing. The connector housing is laterally long and the cavities are arranged in a long side direction of the connector housing. The cover has a guide that fits to a guide receiving portion provided in the long side direction of the connector housing. The guide is moved in the guide receiving portion as the cover is mounted on the connector housing. Then, resiliently deformable mounting pieces provided on the cover are locked to the connector housing to mount the cover at a predetermined position.

The cover of the connector shown in Japanese Unexamined Patent Publication No. 2014-99267 can be removed by displacing the cover to incline sufficiently in one direction to deform a mounting piece on one side toward the cavities and then using a tool to deform the mounting piece on the other side resiliently toward the cavities so that a locked state is released. However, the mounting pieces may be pushed excessively toward the cavities and broken.

SUMMARY

A connector disclosed in this specification includes a connector housing provided with a cavity for accommodating at least one terminal fitting. The connector is connectable to a mating connector. A cover is configured to cover a wire pulled out from the connector housing by being mounted on a cover mounting surface side of the connector housing opposite to a connection surface. Deflectable locking pieces are provided on both side surfaces of the cover and are configured to lock the cover to the connector housing by projecting toward the connector housing. The cover can be inclined with respect to the connector housing so that a first one of the locking pieces is unlocked. A protection wall is provided on the connector housing, and the other locking piece contacts the protection wall when being pushed in an unlocking direction.

According to this configuration, a locking piece that is pushed to be unlocked contacts the protection wall and is not deflected to a degree more than specified. Thus, the locking piece is not deflected excessively and broken. Additionally, when only one locking piece is unlocked and the cover is inclined with respect to the connector housing, the locking piece reliably contacts the protection wall to ensure that the locking piece is not deflected more than expected and broken.

The connector housing may include a slide guide configured to slide and mount the cover in a direction intersecting with a connecting direction to the mating connector and a stopper configured to regulate an end position of a sliding movement and to be located inside the cover. The protection wall may be integral to the stopper. According to this configuration, the strength of the protection wall can be increased by connecting the protection wall to the stopper.

A plurality of wire accommodating tubes connected to the cavities may be provided on the cover mounting surface of the connector housing, and the protection wall may be integrated with a reinforcing rib that links the wire accommodating tubes. According to this configuration, the protection wall is reinforced by the reinforcing rib integrally provided to the wire accommodating tubes so that the strength of the protection wall can be increased.

According to the connector disclosed in this specification, excessive deflection of the locking pieces can be suppressed.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a front view of a connector according to an embodiment.

FIG. **2** is a plan view of the connector.

FIG. **3** is a side view of the connector.

FIG. **4** is a view of a connector housing viewed from a connection surface side.

FIG. **5** is a perspective view of the connector housing.

FIG. **6** is a perspective view of the connector housing.

FIG. **7** is a section along A-A in FIG. **1**.

FIG. **8** is a section along A-A in FIG. **1** showing a state where one locking piece is unlocked by a tool.

FIG. **9** is a partial enlarged section at a position IX in FIG. **8**.

FIG. **10** is a partial enlarged section at a position X in FIG. **8**.

FIG. **11** is a section along A-A in FIG. **1** showing a state where a cover is inclined with respect to the connector housing with the one locking piece unlocked.

FIG. **12** is a partial enlarged section at a position XII in FIG. **11**.

FIG. **13** is a partial enlarged section at a position XIII in FIG. **11**.

FIG. **14** is a section along A-A in FIG. **1** showing a state where the other locking piece is unlocked by the tool.

FIG. **15** is a partial enlarged section at a position XV in FIG. **14**.

FIG. **16** is a section along A-A in FIG. **1** showing a state where the both locking pieces are unlocked.

DETAILED DESCRIPTION

An embodiment is described below with reference to FIGS. **1** to **16**.

A connector C of this embodiment includes a female connector housing **10** and a cover **50** for covering wires pulled out from the connector housing **10** as shown in FIG. **1**. In the following description, a connecting direction and a separating direction of the connector C and a mating connector are referred to as a forward direction and a rearward direction concerning a front-rear direction, a lateral direction is based on FIG. **1** and a vertical direction is based on FIG. **7**.

The connector housing **10** is made of synthetic resin and shaped to be long in the lateral direction. Further, as shown in FIG. **4**, the connector housing **10** includes a connector housing body **11** formed with cavities **13** capable of accommodating terminal fittings, and an outer peripheral portion **21** in the form of a rectangular tube provided on the outer periphery of the connector housing body **11**. A space between the connector housing body **11** and the outer

peripheral portion **21** serves as a connection space K into which the mating connector is inserted at the time of connection.

The cavity **13** is open in the connecting direction (both forward and rearward directions), the terminal fitting is inserted thereinto from behind (side opposite to a connection surface), and a mating terminal fitting accommodated in the mating connector is insertable thereinto from front, i.e. from the side of the connection surface. As shown in FIG. **4**, three types of cavities **13** differing in size are provided. More particularly, large-size cavities **13**A are arranged side by side in upper parts of both end parts of a long side of the connector housing body **10**, and medium-size cavities **13**B for accommodating medium-size terminal fittings are arranged in an area between these large-size cavities **13**A. Further, small-size cavities **13**C for accommodating small-size terminal fittings are arranged above the medium-size and large-size cavities **13**B, **13**A. Note that, in the following description, the cavities **13**A to **13**C are referred to as the cavities **13** when a common configuration is described.

As shown in FIG. **5**, cylindrical wire accommodating tubes **15** are provided to project from a rear surface **10**A of the connector housing **10** to be connected to the respective cavities **13**. Similar to the cavities **13**, three types of wire accommodating tubes **15** differing in size are provided, and the wire accommodating tubes **15**A to **15**C are provided in accordance with the respective cavities **13**A to **13**C. Further, as shown in FIG. **6**, protective ribs **17** integrated with the large-size wire accommodating tubes **15**A are provided between adjacent ones of the large-size wire accommodating tubes **15**A.

As shown in FIG. **3**, both long sides of the outer peripheral portion **21** have a hollow structure formed by inner and outer walls. This hollow portion serves as a slider accommodating chamber **23** for accommodating a slider **40** in the form of a flat plate. Both end parts on the long sides of the both slider accommodating chambers **23** are open so that the sliders **4** can be inserted selectively through both openings. Upper edge parts of wall surfaces constituting the slider accommodating chambers **23** serve as protruding portions **25** that protrude farther up than the upper surface of the connector housing body **11**. Two guide receiving portions **27** are formed in the vertical direction (lateral direction in FIG. **3**) to face each other on inner (front) wall surfaces of these protruding portions **25**. The guide receiving portions **27** are formed along the lateral direction of the connector housing **10** and are provided by forming grooves between the protruding portions **25** and the rear surface **10**A of the connector housing **10**.

As shown in FIGS. **5**, **7**, the protruding portion **25** is cut substantially in the entire range in a protruding direction and over a predetermined width range in a lateral central part, thereby forming a cut **29**. Gears **77** formed on a lever **70** (see FIG. **1**) provided on the cover **50** to be described later are insertable into the slider accommodating chambers **23** through these cuts **29**.

Further, as shown in FIGS. **5**, **7**, the protruding portion **25** is cut at bilaterally symmetrical positions across the cut **29**, thereby forming a pair of escaping portions **31**. The escaping portions **31** have a shorter longitudinal length than the cut **29** and, as shown in FIGS. **5**, **7**, two projecting edges **33** project rearward on left and right opening edges of the escaping portion **31**.

Further, as shown in FIGS. **5**, **7**, two stoppers **35** project rearward while being spaced apart in a short side direction on each of both left and right end parts of the rear surface **10**A of the connector housing **10**. As shown in FIG. **7**, the stoppers **35** come into contact with a short side inner surface of the cover **50** to obstruct a movement of the cover **50** in one direction (leftward direction in FIG. **7**) when the cover **50** is assembled in a proper state with the connector housing **10**.

As shown in FIG. **7**, protection walls **37** integrally extend from upper end parts of the upper stoppers **35** in the long side direction (direction toward a center of the connector housing **10**). The protection wall **37** includes a coupling portion **37**A connected to the stopper **35** in parallel to a side surface of the cover **50** assembled in the proper state to be described later, an inclined portion **37**B oblique to the coupling portion **37**A to extend toward a rear side (side of the wire accommodating tubes **15**) from the coupling portion **37**A and a reinforcing portion **37**C integrated with a triangular reinforcing rib **39** parallel to the side surface of the cover **50** assembled in the proper state to be described later and linking between adjacent ones of the wire tubular portions **15**C. The reinforcing rib **39** projects farther rearward than the wire accommodating tubes **15** and is at the same height as the stopper **35** and the protection wall **37**. Note that a space into which a locking piece **55** to be described later is deflectable is provided between the protection wall **37** and the projecting edges **33**, and a locking projection **55**A can pass between the protection wall **37** and the projecting edges **33** in a state where the locking piece **55** is deflected.

As shown in FIG. **1**, the cover **50** is shaped to cover the connector housing **10** from behind, and is open in a surface on a side facing the connector housing **10** (front side) and a left side surface shown in FIG. **1**. The cover **50** can accommodate a bundle of wires pulled out from the upper surface of the connector housing **10** inside. The cover **50** can be mounted on the connector housing **10** with a lateral orientation changed, thereby exhibiting a function of selectively changing a wire routing direction in accordance with a mounting direction of the cover **50**

As shown in FIG. **3**, guides **51** are provided along the longitudinal direction on lower edge parts of both longitudinal side surfaces of the cover **50**. The guiding portions **51** are movable along the guide receiving portions **27** by fitting the guides **51** into the guide receiving portions **27** of the connector housing **10**. Further, a sliding groove **53** integrated with the rear surface of the guide **51**, open outward and having a substantially C-shaped cross-section is formed behind the guide **51**. The sliding groove **53** is fit to the protruding portion **25** of the connector housing **10** to be movable along this protruding portion **25**. That is, the guides **51** can guide the cover **50** in a direction perpendicular to the connecting direction with the guides **51** fit in the guide receiving portions **27** and the protruding portions **25** fit in the sliding grooves **53**.

Further, as shown in FIG. **7**, the locking piece **55** is provided in a lateral orientation at a somewhat leftward position in a central part in the sliding groove **53**. The locking piece **55** is cantilevered along the lateral direction and formed to be deflectable in a thickness direction (short side direction of the cover **50**). The locking piece **55** includes the locking projection **55**A projecting outward (in the front-rear direction), and the cover **50** is locked to the connector housing **10** by locking the locking projections **55**A to the projecting edges **33**A on a central side in the long side direction.

As shown in FIG. **1**, two support shafts **57** for mounting the lever **70** are formed integrally to project on both longitudinal side surfaces of the cover **50**. A right side of the upper surface of the cover **50** in FIG. **1** is formed to be

moderately sloped down to avoid interference when the lever **70** is at a standby position, and a lever lock portion **59** (see FIG. **2**) for locking the lever **70** at the standby position projects at a right end part of this upper surface.

As shown in FIGS. **1**, **2**, the lever **70** is composed of a pair of side plates **71** and an operating portion **73** coupling tip parts of both side plates **71**. Mounting holes **75** penetrate through central parts of the side plates **71** and are fit to the support shafts **57** so that the lever **70** in a retained state is rotatable about the support shafts **57**.

The outer edge of the side plate **71** of the lever **70** is formed into an arcuate shape centered on a center of rotation of the lever **70**. Further, a total of three gears **77** are engraved at uniform intervals on a peripheral edge part of an outer surface side of each of the side plates **71** while leaving a material on an inner surface side. Further, stopper teeth **79** are formed on the same peripheral surfaces as the respective gears **77**. These stopper teeth **79** (see FIG. **7**) are in contact with rack teeth provided on rear edge parts of the sliders **40** when the lever **70** is at the standby position, thereby obstructing movements of the slider **40** so that the sliders **40** do not move inadvertently.

Next, how to remove the cover **50** from the connector housing **10** is described using FIGS. **7** to **16**. As shown in FIG. **7**, when the cover **50** is mounted in a proper state on the connector housing **10**, two locking projections **55**A of the cover **50** lock the projecting edges **33**A on the central side of the connector housing **10**, thereby suppressing a movement of the cover **50** to a right side shown in FIG. **7**. Further, the inner wall on the short side of the cover **50** comes into contact with the stopper portions **35**, thereby suppressing a movement of the cover **50** to a left side shown in FIG. **7**. The guides **51** and the sliding grooves **53** of the cover **50** are fit to the guide receiving portions **27** and the protruding portions **25** of the connector housing **10** so that a vertical movement of the cover **50** also is suppressed.

To remove the cover **50** from the connector housing **10** from this state, the cover **50** needs to be enabled to move rightward. First, the lower (side of the wire accommodating tubes **15**A) locking projection **55**A is pushed in (up) by a tool as shown in FIG. **8**. Thus, the locking piece **55** is deflected and the locking projection **55**A is disengaged from the lower projecting edge **33**A on the central side as shown in FIG. **9**. Note that excessive deflection of the locking piece **55** is suppressed by the locking piece **55** coming into contact with the protection rib **17**. Further, in this state, a clearance S is provided between a right-upper part of the cover **50** and the projecting edges **33** as shown in FIG. **10**. This clearance S is provided to allow molding errors and the like of the connector housing **10** and the cover **50**.

As shown in FIG. **8**, the lower locking projection **55**A is inclined slightly toward to a right-upper side to fill up the clearance S on the right-upper side as shown in FIG. **11** from the state where the lower locking projection **55**A is disengaged from the projecting edge **33**A on the central side. Specifically, as shown in FIG. **13**, the clearance S between the connector housing **10** and the cover **50** is eliminated on the right-upper side and the cover **50** is in contact with the projecting edges **33** of the connector housing **10**. By inclining the cover **50** with respect to the connector housing **10** in this way, the lower locking projection **55**A is held over the projecting edge **33**A on the central side as shown in FIG. **12**.

The upper (side of the wire accommodating tubes **15**C) locking projection **55**A is pushed in (down) by the tool, as shown in FIG. **14**, when the lower locking piece **55** is unlocked and the cover **50** is inclined with respect to the connector housing **10** in this way. Thus, the locking piece **55** is deflected and the locking projection **55**A is disengaged from the upper projecting edge **33**A on the central side, as shown in FIG. **15**. At this time, a tip part of the locking piece **55** is pressed by the tool, and the locking piece **55** is deflected along the inclined portion **37**B of the protection wall **37**, but stops deflection by coming into contact with the reinforcing portion **37**C. That is, excessive deflection of the locking piece **55** is suppressed by the locking piece **55** coming into contact with the protection wall **37** when the locking piece **55** is pushed in an unlocking direction (inward) by the tool.

Then, as shown in FIG. **16**, the cover **50** is moved rightward with the both locking pieces **55** unlocked, and the locking projection **55** moves onto the upper projecting edge **33**A on the central side to maintain an unlocked state. By moving the cover **50** farther rightward and pushing the locking piece **55** in the unlocking direction (inward) by the tool as appropriate from this state, the cover **50** is removed from the connector housing **10**.

As described above, in this embodiment, even if the second locking piece **55** is pushed by the tool when only one locking piece **55** is unlocked and the cover **50** is inclined with respect to the connector housing **10**, the locking piece **55** reliably comes into contact with the protection wall **37** and is not pushed any farther when being pushed to a degree more than specified. Thus, it is suppressed that the locking piece **55** is excessively deflected and broken. Further, since the protection wall **37** is integrated with the stopper **35** and the reinforcing rib **39**, the strength of the protection wall **37** can be increased.

The specification is not limited to the above described and illustrated embodiment. For example, the following various modes are also included.

Although the protection wall **37** is integrated with the stopper portion **35** and the reinforcing rib **39** in the above embodiment, the protection wall **37** may be integrated with only either one of them or may be singly provided.

Although the cover **50** is mounted by being laterally slid with the guide portions **51** fit in the guide receiving portions **27** and the protruding portions **25** fit in the sliding grooves **53** in the above embodiment, the cover **50** may be mounted on the connector housing **10** by another method using a locking piece.

LIST OF REFERENCE SIGNS

10 . . . connector housing
10A . . . rear surface (cover mounting surface)
13 (**13**A to **13**C) . . . cavity
15 (**15**A to **15**C) . . . wire accommodating tube
25 . . . protruding portion (slide guide portion)
27 . . . guide receiving portion (slide guide portion)
31 . . . escaping portion
33 . . . projecting edge
33A . . . projecting edge on central side
35 . . . stopper
37 . . . protection wall
37A . . . coupling portion
37B . . . inclined portion
37C . . . reinforcing portion
39 . . . reinforcing rib
50 . . . cover
51 . . . guide
53 . . . sliding groove
55 . . . locking piece
55A . . . locking projection
C . . . connector

The invention claimed is:

1. A connector, comprising:

a connector housing provided with cavities for accommodating terminal fittings and connectable to a mating connector;

a cover configured to cover a wire pulled out from the connector housing by being mounted on a cover mounting surface side of the connector housing opposite to a connection surface;

locking pieces deflectably provided on both side surfaces of the cover and configured to lock the cover to the connector housing by projecting toward the connector housing;

locked portions provided on the connector housing and to be locked by the locking pieces; and

a protection wall provided on the connector housing, the other locking piece coming into contact with the protection wall when being pushed in an unlocking direction when one of the locking pieces is unlocked and the cover is inclined with respect to the connector housing,

the protection wall including an incline portion inclined to gradually increase a distance from the locked portion.

2. The connector of claim 1, wherein:

the connector housing includes a slide guide portion configured to slide and mount the cover in a direction intersecting with a connecting direction to the mating connector and a stopper portion configured to regulate an end position of a sliding movement and to be located inside the cover; and

the protection wall is integrally provided to the stopper portion.

3. The connector of claim 2, wherein a plurality of wire accommodating tubes connected to the cavities are provided on the cover mounting surface of the connector housing, and the protection wall is integrated with a reinforcing rib provided to link between the wire accommodating tubes.

4. The connector of claim 1, wherein a plurality of wire accommodating tubes connected to the cavities are provided on the cover mounting surface of the connector housing, and the protection wall is integrated with a reinforcing rib provided to link between the wire accommodating tubes.

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